

## C-A OPERATIONS PROCEDURE MANUAL

### C-A TPL 08-07 TEMPORARY PROCEDURE FOR RHIC OPERATION WITH ROMAN POTS

Text Pages 2 through 7

#### Hand Processed Changes

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Assoc. Chairman for Safety Date

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## C-A TPL 08-07 TEMPORARY PROCEDURE FOR RHIC OPERATION WITH ROMAN POTS

### 1. Purpose

- 1.1 The purpose of this procedure is to outline, for the MCR Operators and Operations Coordinators (OCs), the constraints on the operation of the Roman Pots in RHIC on opposite sides of IP6). This procedure restricts:
  - 1.1.1 the operation of the Roman Pot drives to pp2pp experimenters AFTER they have received permission from the Operations Coordinator to drive the pot.
  - 1.1.2 the adjustment of the motor drive stops to the pp2pp Liaison Engineer.
  - 1.1.3 the setting of the NMC threshold for the beam permit system to the pp2pp Liaison Physicist.
  - 1.1.4 the setting of the RHIC Beam Permit Link masks to the MCR RHIC Machine Specialist.
  - 1.1.5 the operation of the Roman Pot drives if the NMC protection system is not working
  - 1.1.6 the movement of the beam pipe.
- 1.2 This procedure is to be used whenever the Roman pots are driven towards the circulating proton beam in RHIC.
- 1.3 The Roman Pots are detectors used by the pp2pp/STAR experiment in RHIC. They are physically driven in to a position close to the circulating beam. For FY'08 four Roman Pot "stations" are installed (2 in yellow and 2 in blue) on either side of IP6. Each active station contains two (an inner and an outer or an upper and lower) Roman Pots.
  - 1.3.1 The array consists of: Yellow Sector 5 pot 3 (L & R), Yellow Sector 5 pot 4 (Top & Bottom), Blue Sector 6 pot 1 (L & R), Blue Sector 6 pot 2 (Top, Bottom)
- 1.4 For Run8 it is expected that pp2pp will run parasitically to STAR such that the pots will be driven to a limiting position determined by the Accelerator Systems Safety Review Committee and the pp2pp Liaison Physicist.

### 2. Responsibilities

- 2.1 The Operations Coordinator (OC) is responsible to give permission to operate the Roman Pot drives after the RHIC beams are stored and no significant horizontal or vertical tuning is planned in either ring.
- 2.2 The pp2pp Liaison Physicist or his designee is responsible to set the mechanical and electrical stops for the Roman Pot drives and to set stops for beam/vacuum pipe motion.
- 2.3 The pp2pp Liaison Physicist will control the High/Low Intensity keys (locked in 5E & 7W). The key-switch position determines how close to the beam the pots may be driven
- 2.4 The pp2pp Liaison Physicist is responsible for establishing the Roman Pot drive position limits as inputs to the beam permit system.
- 2.5 The MCR RHIC Machine Specialist is responsible for setting permit masks and enabling permit inputs for the motor drives, the NMC units, and the beam pipe position limit. Further he is responsible for seeing that a TAPE is written to retract the pots before beam is injected or dumped.

- 2.6 The pp2pp Liaison Physicist shall set the threshold for the NMC units used to abort the beam.
  - 2.7 The operators are responsible to drive the pots home when they see a WATCH pot position alarm prior to injection or prior to beam abort.
3. Prerequisites
- 3.1 The physical (electrical) limits for the Roman Pot drive positions have been set by the Liaison Engineer for the pp2pp experiment. The limits are set for:
    - 3.1.1 5 mm for low intensity (close-in operation @  $5 \times 10^{12}$  protons &  $\beta^* = 20\text{m}$ ) and
    - 3.1.2 20 mm Horizontal, 40 mm Vertical for high intensity ( $\beta^* = 0.9\text{m}$ ) operation. The distances refer to how close the pot can get to the beam center line.
  - 3.2 The threshold for the NMC monitors has been initially set to 100 Rad/hr in order to pull the permit link.
  - 3.3 The MCR RHIC Machine Specialist or his designee shall:
    - 3.3.1 see that a TAPE is written to command the motors to drive the pots to their retract limits prior to injection and prior to beam dump/abort, and to check that they are retracted.
    - 3.3.2 See that, during pp2pp operation, the permit inputs are masked and disabled for the motor drives, and unmasked and enabled for the NMC units, and the beam pipe position limit.
  - 3.4 The pp2pp Liaison Engineer has placed authorized operator OR do not operate (yellow) tags on the beam pipe motion control.
  - 3.5 The WATCH program must be running to generate alarms when the pots are off the retract limits.
  - 3.6 The target group for this procedure is the MCR Operators and OCs, the RHIC Machine Specialist and the pp2pp Liaison Physicist.
  - 3.7 The training requirement for this procedure is read and sign.
  - 3.8 The minimum number of staff members that need to be trained in order for this procedure to be effective is three, one OC and one operator, and the pp2pp Liaison Physicist.
4. Precautions
- 4.1 The Roman Pots shall be retracted before protons are injected.
    - 4.1.1 The LVDT (retract) readbacks should be on the order of  $\pm 71$  mm for each of the four drives found at pet/RHIC/Interaction\_Regions/PP2PP/RomPotCtrl/Sector5(6)/
    - 4.1.2 IF the Roman Pots are not retracted before injection then the WATCH program will generate an alarm and the RHIC beam permit link will not pull the permit link. The pots must be retracted prior to beam abort as well. Expect TAPE to do the work of moving the pots.
    - 4.1.3 Abort kicker pre-fire may cause beam to hit a horizontal pot.
    - 4.1.4 Significant beam scatter from a Roman pot detector may cause a quench of a spin rotator in sector 5 or 6.

5. Procedure

**Caution 1:**

To RETRACT the Roman pots use **pet/RHIC/Interaction\_Regions/PP2PP/RomPotCtrl/Sector5(6)** and click **home** on each of the four steppers (Up, Dn, Top, Bottom) in sector 5 and sector 6. Observe “Retracted” under “at limit?” to confirm outer limit switch was picked up.

5.1 Pre-Operations (prerequisites) -- Before operation of the Roman Pots is allowed:

5.1.1 The Accelerator Systems Safety Review Committee and Experimental Safety Review Committee checklists shall be signed in the appropriate places.

5.1.2 The MCR RHIC Machine Specialist (MCR RMS) shall mask pot position inputs to the RHIC Beam Permit Link at pet/RHIC/Links/Permit/7/7w/Blue Roman Pot 1(2) and at pet/RHIC/Links/Permit/5/5e/Yellow Roman Pot 3(4).

**Note 1:**

“Masking” will cause the RHIC Beam Permit pot position inputs to be ignored if the Roman Pots are moved from the “retract limit” position.

5.1.2.1. The MCR RMS shall confirm that the permit inputs for pot positions are masked and disabled and that permit inputs for radiation monitors (NMCs), and beam pipe position, are enabled and unmasked.

5.1.3 The pp2pp Liaison Engineer shall physically limit the travel of each of the four Pots as agreed to with the Accelerator Systems Safety Review Committee.

5.1.3.1 The ASSRC limits for individual pot motions are listed in paragraph 3.1 above.

5.1.4 The pp2pp Liaison Physicist and engineer shall set the thresholds for NMC monitors associated with the Roman Pots to disable the Beam Permit Link when the threshold is reached. The thresholds will be determined with the assistance of members of the ASSRC. The NMC system will be the means of protecting accelerator and experimenter equipment.

5.1.4.1 The NMC inputs to the beam permit system must be tested to insure the ability of each pot to disable the beam permit (ASSRC checklist (Jan 31) item CK-05).

5.1.4.2 The NMC thresholds may be changed with the concurrence of the pp2pp Liaison Physicist and the Acting Chairman of the ASSRC

5.1.5 The four High/Low intensity keys for the roman pots will be controlled by the pp2pp Liaison Physicist in the captured key locker in the 5E & 7W houses. The default setting is for High Intensity operation. They may be released for the low intensity run after the pp2pp Liaison Physicist has obtained permission from the ASSRC.

5.1.6 The pp2pp Liaison Engineer shall put a do not operate or Authorized Operator yellow tag on the beam pipe motion drive wheel, used to move the beam pipe in order to service the horizontal pots.

## 5.2 Operation

### **Caution 2:**

Beam damage to the Roman Pots may occur and the RHIC vacuum may be spoiled. Should this happen, contact the Associate Chair for ESHQ and initiate a critique. This is not considered a DOE reportable occurrence.

### **Caution 3:**

**The OC shall not give permission to drive the Roman Pots towards the center line if “two” NMC protection systems are not working (minimum of ONE in sector 5 and ONE in sector 7 is required for operation).**

#### 5.2.1 **High Intensity RHIC Operation** (see paragraph 3.1 for high intensity conditions)

5.2.1.1 After the beams are stored a member of the pp2pp collaboration will contact the Operations Coordinator to get permission to insert the roman pots.

5.2.1.2 The responsibility of the MCR operators, for both low and high intensity operation, is to look for alarms (NMC = high radiation, beam pipe position, and roman pot not at retract limit position) related to pp2pp operation and to respond to them.

5.2.1.2.1 Operators are required to know how to drive a pot to it's retract limit if the pot is not retracted at injection or prior to beam abort.

5.2.1.2.2 A TAPE is written to retract the pots and to check to see the pots are at their retract limit. Until the roman pot motors are powered and all the limit switches “picked up” the check step has been disabled in the TAPE.

#### Note 2:

This step needs to be executed only ONCE, for each pair of pots – that is -- only when the pot pair is inserted for the first time.

5.2.1.3 IF beam steering and horizontal and vertical tuning is complete THEN the Operations Coordinator will give permission to the pp2pp experiment to drive in the pots.

5.2.1.4 IF the beam permit is lost due to an NMC interlock (paragraph 5.3.4) THEN

5.2.1.4.1 Review the loss monitor post mortem data

5.2.1.4.2 Attempt to determine the source of the problem

5.2.1.4.3 Consult the Run Coordinator if the problem cannot be found

5.2.1.4.4 Resume operation when the source of the problem is corrected.

5.2.1.5 The pots are automatically retracted by TAPE at the end of the store.

#### 5.2.2 **Low Intensity RHIC Operation** (RHIC operation dedicated to the pp2pp experiment. See paragraph 3.1 for low intensity conditions.)

**Caution 4:**

Data taken during high intensity operation will be reviewed by a subcommittee of the ASSRC before low intensity operation is permitted. The subcommittee shall approve low intensity operation.

- 5.2.2.1 The MCRGL or his designee shall set the RHIC beam current transformer alarm limit for  $5 \times 10^{12}$  protons in each ring.
- 5.2.2.2 The pp2pp Liaison Physicist shall switch the High/Low intensity key-switches to the Low intensity position.
- 5.2.2.3 After the beams are stored in each ring the RHIC Liaison Physicist shall scrape the beams until no more than  $5 \times 10^{12}$  protons remain circulating in each ring AND the beam current transformer alarm condition is gone.
- 5.2.2.4 IF beam steering and horizontal and vertical tuning is complete THEN the Operations Coordinator will give permission to the pp2pp experimenters to drive in the pots.
- 5.2.2.5 IF the beam permit is lost due to an NMC interlock (paragraph 5.3.4) then
  - 5.2.2.5.1 Review the loss monitor post mortem data
  - 5.2.2.5.2 Attempt to determine the source of the problem
  - 5.2.2.5.3 Consult the Run Coordinator if the problem cannot be found
  - 5.2.2.5.4 Resume operation when the source of the problem is corrected
- 5.2.2.6 The pots are automatically retracted by TAPE at the end of the store.
- 5.3 Controls & Alarms
  - 5.3.1 To drive the pots out:
    - 5.3.1.1 Click on the **HOME** button found at pet/RHIC/Drives/romanPots/Sector5(6)
  - 5.3.2 Permit status/control
    - 5.3.2.1 pet/RHIC/Permit/7(5)/7w(5e)
  - 5.3.3 NMC readbacks and all controls
    - 5.3.3.1 pet/RHIC/Interaction\_Regions/PP2PP/RomPotCtrl/Sector5(6)
  - 5.3.4 High Radiation Alarm – NMC pulls the permit
    - 5.3.4.1 alarm is recognized as *permit.7w-ps2.A\_BlueRomanPot1(2)NMC* or *permit.5e-ps2.A\_YellowRomanPot1(2)NMC*
    - 5.3.4.2 Respond according to paragraph 5.2.1.3.
    - 5.3.4.3 Beware – other loss events in RHIC may activate the NCM permit inputs**
  - 5.3.5 Beam Pipe not “home” after horizontal pot serviced.
    - 5.3.5.1 Alarm is recognized as *permit.7w-ps2.A\_YellowRPbeampipe* or *permit.5e-ps2.A\_BlueRPbeampipe*.
    - 5.3.5.2 Response – contact pp2pp Liaison Engineer to enter tunnel and drive the beam pipe home
  - 5.3.6 Roman pot not retracted before injection.
    - 5.3.6.1 WATCH alarm is recognized as *rp-b-2-bot(top)-mot*, *rp-b-1-left(right)-mot*, *rp-y-4-bot(top)-mot*, *rp-y-3-left(right)-mot*.
    - 5.3.6.2 Response drive the alarming pot to the retract position- paragraph 5.3.1

#### 5.4 Roman Pot Inspections

5.4.1 If the beam permit is pulled due to excessive radiation levels at the NMC then an inspection of the roman pots may be ordered by the ASSRC Chairman or the Liaison Engineer.

5.4.1.1 IF an inspection is ordered then the Liaison Engineer shall retract the pots and inspect them.

5.4.1.2 An ASSRC subcommittee shall participate in the inspection

5.4.1.3 The ASSRC subcommittee and the Liaison Engineer must agree that continued operation will be permitted.

#### 6. Documentation

6.1 None

#### 7. References:

7.1 None

#### 8. Attachments:

8.1 None